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(54) **Drilling Vessels**

(57) A vessel (1) for drilling hydrocarbon wells in the sea floor, such as a drill ship or a semi-submersible platform, is provided with a drilling tower (6) which is dimensioned and constructed to receive at least two drill strings (7*a*, 7*b*). Preferably, the mutual spacing between the drill strings is substantially equal to an integral multiple of the desired spacing between neighbouring wells and is at least equal to the spacing required to enable the drill strings to be operated concurrently.

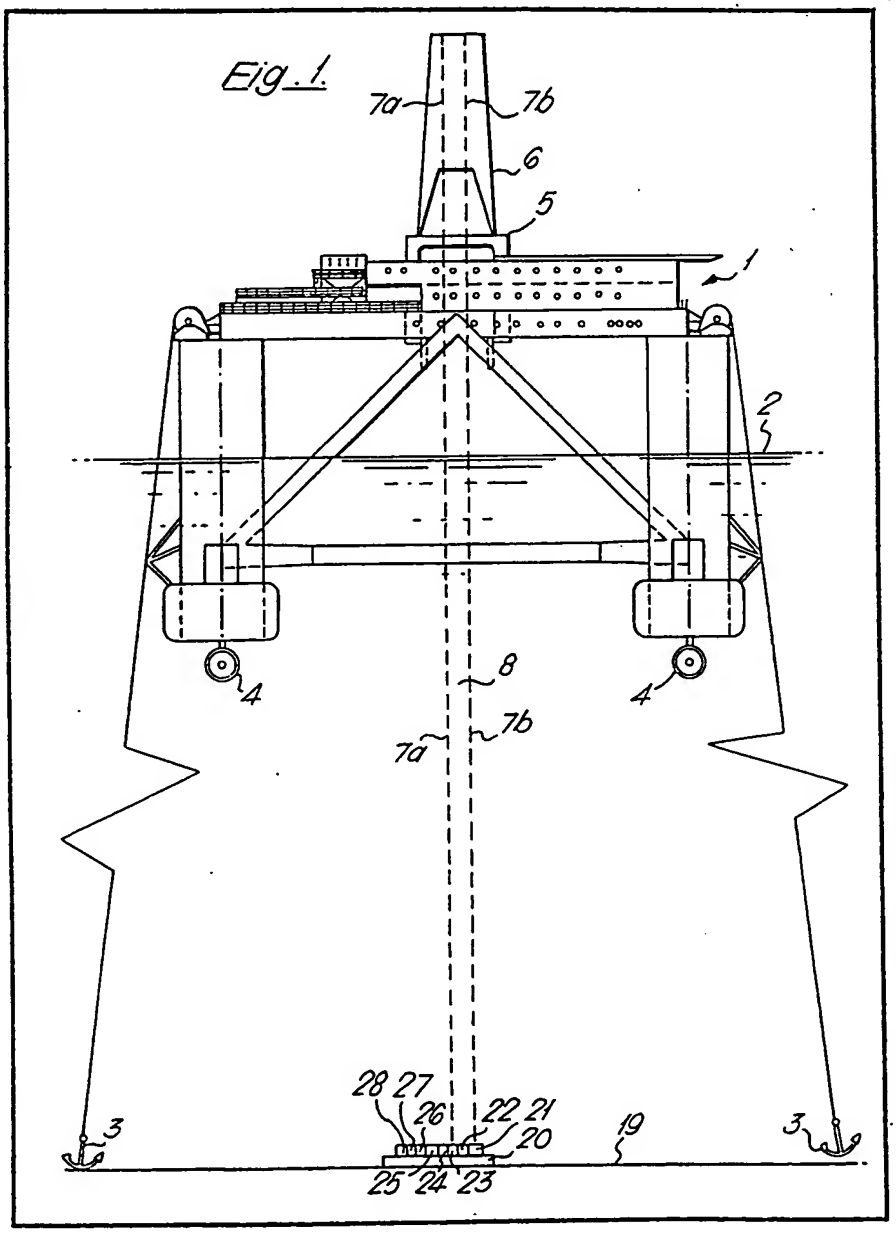

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Fig. 1.

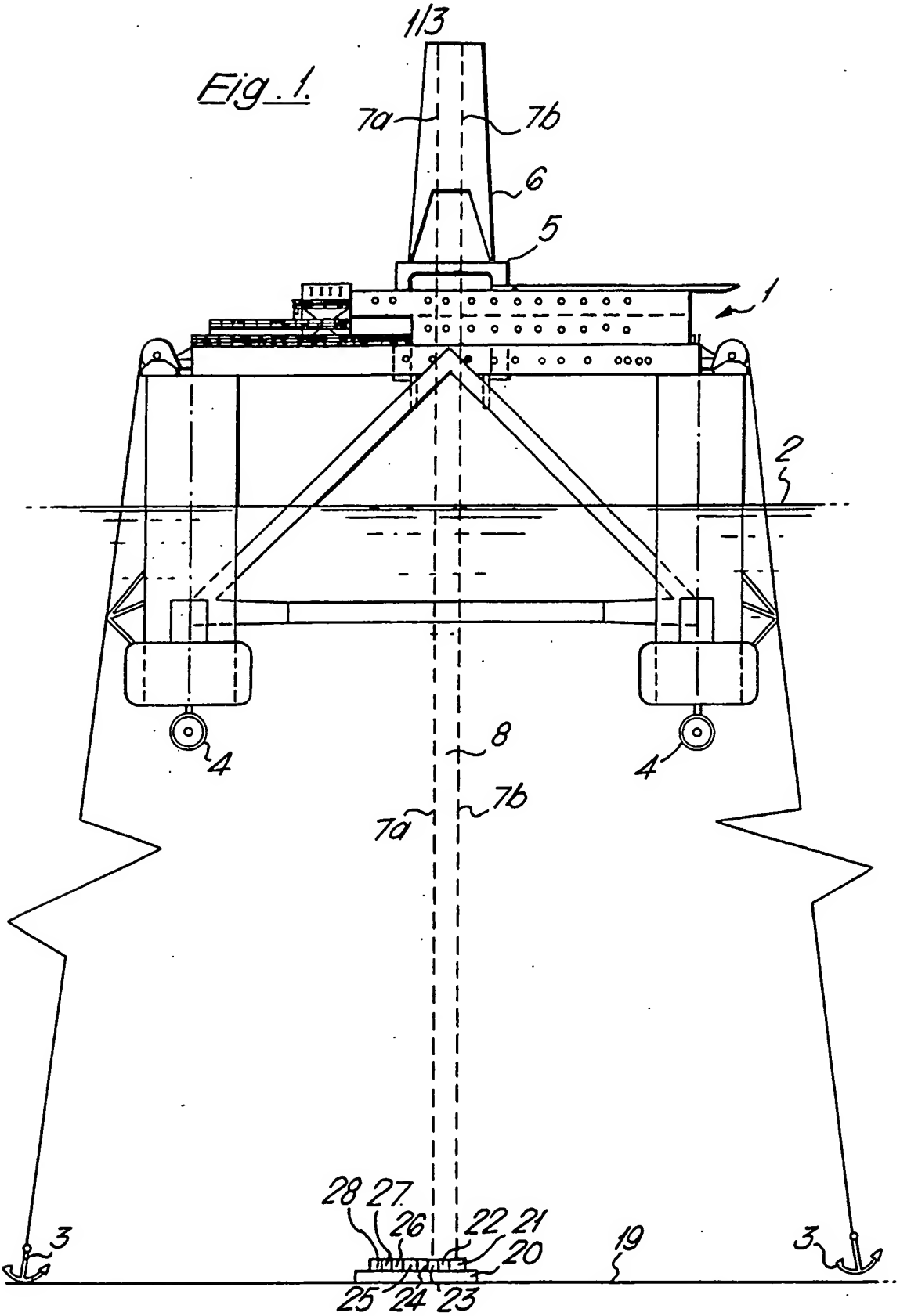


Fig. 2.

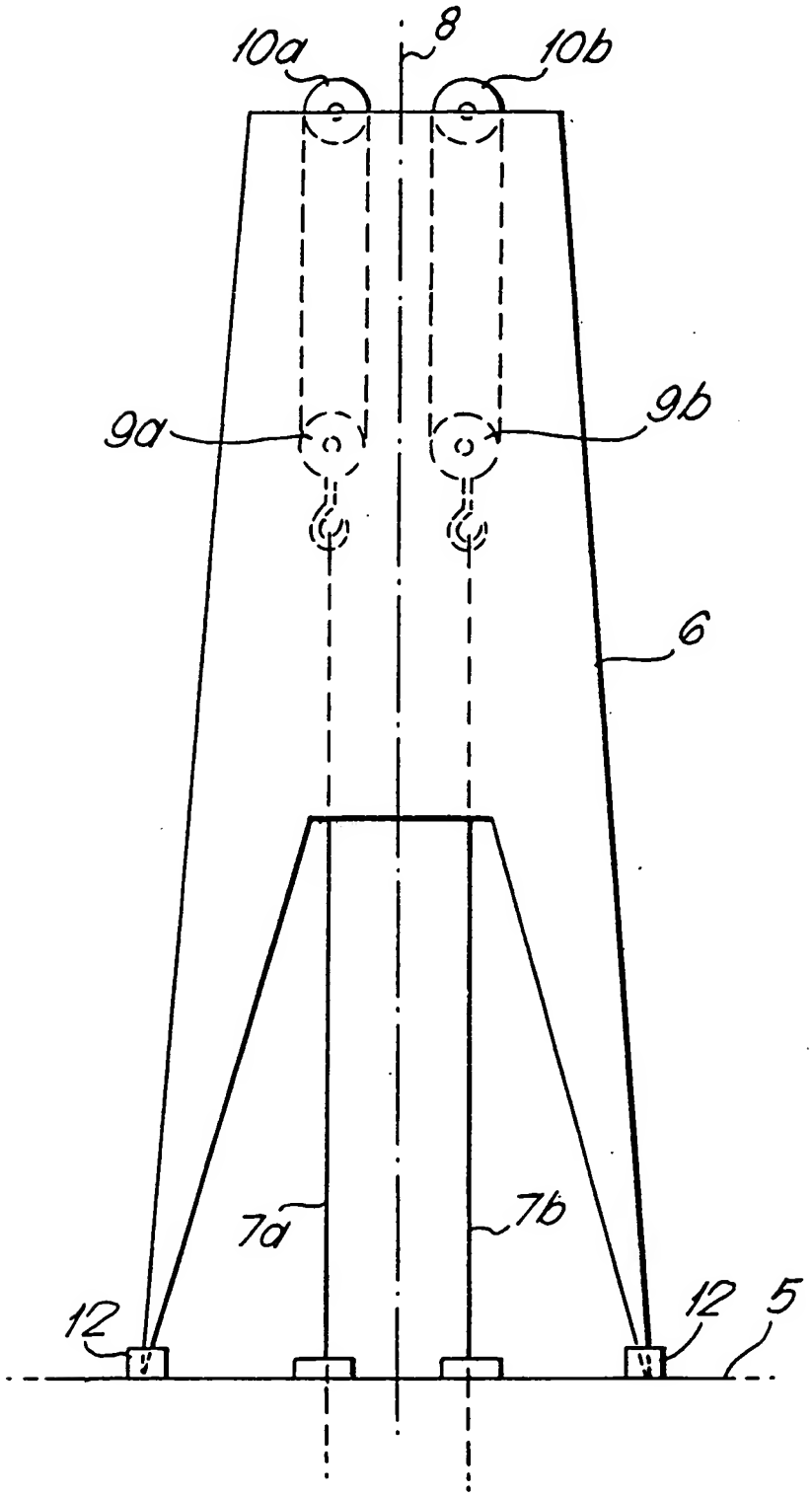
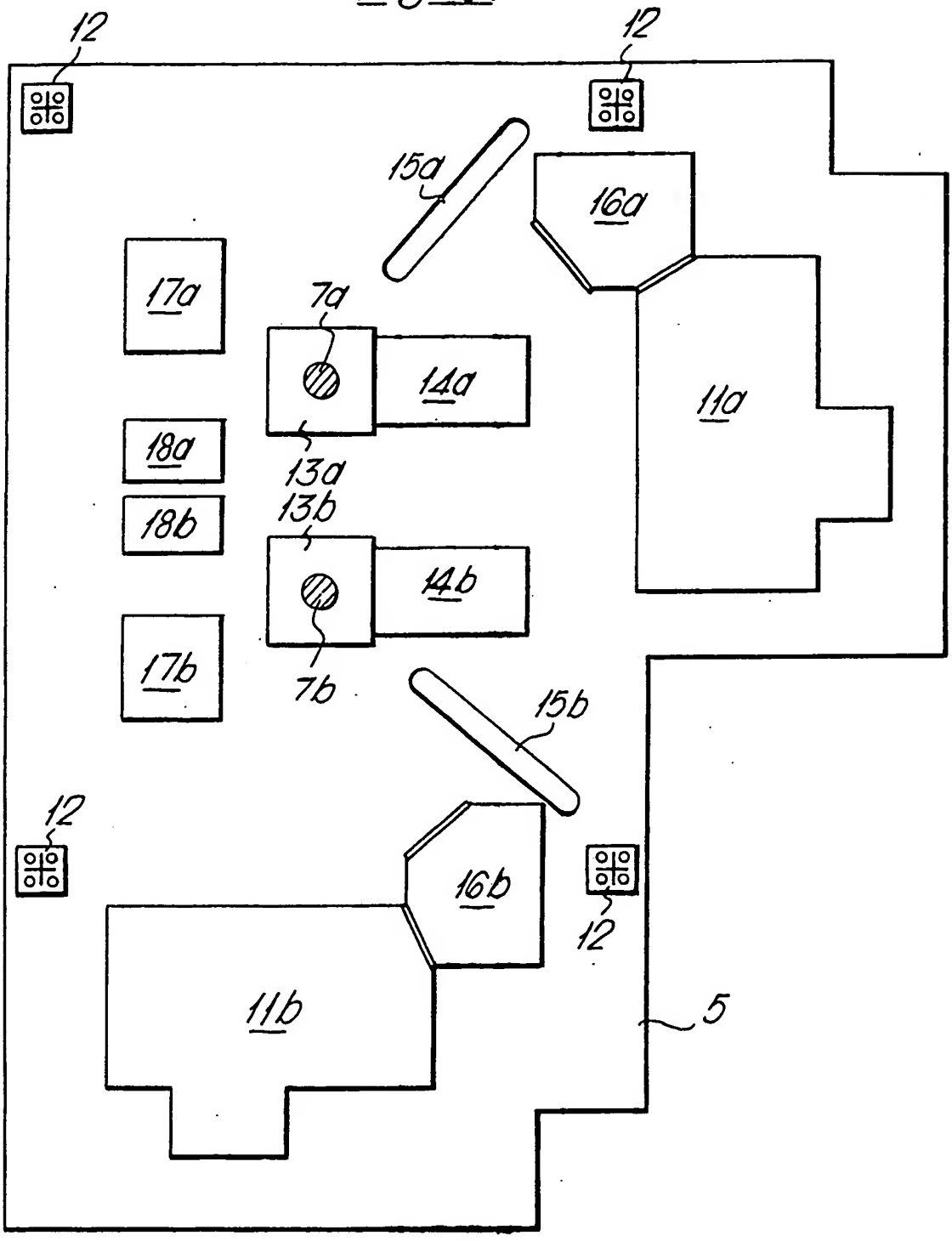


Fig. 3.


12
12
15a
16a
17a
7a
14a
11a
18a
13a
13b
18b
14b
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7b
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16b
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5

SPECIFICATION

Vessel for, and Method of, Drilling Hydrocarbon Wells

The present invention relates to a vessel for drilling hydrocarbon wells in the sea floor and to a method of drilling hydrocarbon wells.

Drilling vessels in the form of ships or semi-submersible platforms for drilling of hydrocarbon wells in the sea floor in so-called offshore areas are well known. Such vessels have been used for drilling test wells in exploration for hydrocarbon deposits. For this purpose the vessels are anchored and/or held in place by means of dynamic positioning at the place in question. The vessels are provided with a drilling tower and appurtenant equipment for a drill string, by means of which the test wells are drilled one at a time. When deposits of hydrocarbons have been found in this way, the extent and production capacity of the deposits are next decided. If the deposit is found to be exploitable, a more permanent structure is built and is arranged fixed on the sea floor at the production site in question. From this fixed structure a large number of production wells are usually drilled, the completions of which at the sea floor lie relatively close to each other in order that the production from the various wells may more easily be connected to common riser pipes and for easier control and maintenance of the wells. Since the number of wells below such a fixed structure may be relatively high, e.g. 20, and the drilling of each single hole can take several months, a long time will pass before the production of the hydrocarbons can start. This entails high cost, inter alia for interest on the investments in the fixed structure and the wells already drilled. The delayed income from production, which for a typical oil field in the North Sea amounts to several hundred thousand £ sterling per day, will often also be of considerable importance.

In order to shorten the time from the decision to put an oil field into production until the production can start, one has in some cases started drilling of the production wells before installation of the fixed production structure. The construction of the production structure, which to a large extent usually occurs onshore may take more than a year, and concurrently as many production wells are drilled as time permits before the production structure arrives and is placed on the sea floor.

Such advance drilling may be performed by means of a drilling rig or a drilling vessel of the type used for test drilling and mentioned above. In pelagic areas having extreme weather conditions or ice difficulties, such vessels have a relatively short drilling season. Furthermore, the holes which are to be drilled will lie close to each other so that it is not possible to use several vessels concurrently. Therefore, only a very limited number of production wells can be drilled in advance, thus necessitating that most of the wells are drilled following the installation of the production structure.

It is the purpose of the invention to overcome the above-noted deficiencies, thus making it possible to advance the production of hydrocarbons from an offshore field while concurrently reducing the cost of the production preparations to a considerable degree.

According to one aspect of the present invention there is provided a vessel for drilling hydrocarbon wells in the sea floor, the vessel including a drilling tower dimensioned and constructed to receive at least two drill strings.

Preferably, the vessel includes appurtenant equipment for each of the drill strings.

The mutual spacing between the drill strings is preferably at least equal to the spacing required to enable the drill strings to be operated concurrently.

Preferably, the number of drill strings is two and preferably the appurtenant equipment for the two drill strings is arranged at a mutual angle of subtantially 90°.

The mutual spacing between the drill strings is preferably substantially equal to an integral multiple of the desired spacing between neighbouring wells.

Thus, the drilling vessel may be built as a usual test drilling rig without appreciable additional cost due to the relatively small extra size and strength which is required in the drilling tower. The rig may originally be delivered with only one set of drilling equipment for customary test drilling. If at a later time it is desirable to use the drilling rig for advance drilling of production wells one can relatively quickly and with simple means install the necessary equipment for further drill strings. Since the drill strings are placed close to each other these may be operated concurrently without the resulting wells lying too far from each other to be connected to a common riser pipe or to be maintained from the production platform.

Arranging the drill strings in the same tower has several advantages as compared to arranging each drill string in a separate tower. Firstly, the total weight will be less. Secondly, the weight of the drilling equipment may be concentrated near the middle of the vessel in order not to influence its stability to any great extent. Thirdly, the placement of the drilling equipment near the centre of the vessel will give rise to less relatively motion between the drill strings and the vessel when the latter heaves and rolls in a heavy sea. Furthermore, only a single drilling tower will give rise to less wind forces and better stability also for this reason. Of other obvious advantages, there is the possibility of concentrating common auxiliary equipment and permitting better surveying and coordination. The use of two drill strings in the same tower makes it possible to place the appurtenant equipment for the drill strings close to the vertical centre line of the vessel, inter alia by placing parts of the equipment at a mutual angle of approximately 90° without reducing the access to the various parts to any significant degree. The central arrangement of the

equipment enhances the stability of the vessel.

For a better understanding of the present invention and to show more clearly how it may be carried into effect reference will now be made, by way of example, to the accompanying drawings in which:—

Fig. 1 shows an elevation of a drilling vessel of the semi-submersible type provided with an arrangement according to the present invention;

Fig. 2 shows schematically a part of Fig. 1, but on a larger scale; and

Fig. 3 shows a plan view of the drill floor of the vessel with the drilling tower removed.

There is shown in Fig. 1 a drilling vessel 1 of generally conventional form. The vessel is of the so-called semi-submersible type which in operating position is ballasted to a draft approximately as shown in the figure with respect to the water surface 2. The vessel is held in position by means of anchors 3 and/or equipment for dynamic positioning, as indicated at 4.

Above the other decks of the vessel, a drill floor 5 is arranged, supporting a drilling tower 6 and appurtenant equipment (not shown in Fig. 1) for two drill strings 7*a*, 7*b* indicated in broken lines. The drilling tower 6 is preferably arranged coaxially with the centre line 8 of the vessel, one drill string lying on each side of the centre line in order to give the most symmetrical and central loading.

Figs. 2 and 3 show further details of the drill floor 5, the drilling tower 6 and the appurtenant equipment. For each drill string 7*a*, 7*b*, a running tackle 9*a*, 9*b* and a top block 10*a*, 10*b* with hoisting machinery 11*a*, 11*b* are arranged in the usual way. The hoisting machineries, as is apparent from Fig. 3, are arranged at 90° with respect to each other so that they may be placed as close to the central axis of the vessel as possible without obstructing the necessary view and access. Other necessary equipment for the drill strings 7*a*, 7*b* is arranged between the foundations 12 for the legs of the drilling tower. This equipment comprises rotation tables 13*a*, 13*b* and corresponding driving machinery 14*a*, 14*b*, so-called rat holes 15*a*, 15*b*, the driller's control room 16*a*, 16*b* and storage places for drilling pipe etc. 17*a*, 17*b*; 18*a*, 18*b*. The equipment is placed so that it may be surveyed by the driller during the drilling operation.

When drilling from a floating vessel it is necessary to enclose the drill string in a so-called riser pipe, the lower end of which is attached to a base plate on the sea floor and the upper end of which is movably supported in the vessel. Due to its great length the riser pipe has a certain flexibility and may be deflected with respect to the vertical due to for instance sea currents, waves and the motion of the vessel. When using two drill strings according to the invention it may also be necessary to have two riser pipes, one for each drill string. Due to their lateral motion the riser pipes are generally arranged with a certain mutual spacing, and in many cases this spacing will determine how close together the drill strings may be arranged and thus also the distance between the wells on the sea floor. However, this spacing will usually not be so large as to cause appreciable problems.

Should one wish a closer well spacing than indicated by the drill string spacing, one may arrange the drill strings so that the distance between the wells thus drilled is large enough to give room for one or more further wells. Fig. 1 illustrates how the invention comtemplates a method for obtaining this objective. A base plate 10 or template having guides 21—28 is placed on the sea floor 19. Each guide will later give room for a well head. In the position shown, the drill strings 7*a*, 7*b* drill wells through the guides 21 and 23, the guide 22 lying in between. Next, the drilling vessel 1 is moved so that the drill strings drill through the guides 22 and 24. Thereafter the drilling vessel 1 is moved so that wells may be drilled through the guides 25 and 27, and finally wells are drilled through the guides 26 and 28.

The base plate and the drill string distance may of course also be adapted so that two or more well points will lie between two concurrently drilled wells. It will be seen from Fig. 1 that if the distance between the drill strings had been twice as large, one would have first drilled through the guides 21 and 25 in the base plate, thereafter through 22 and 26, followed by 23 and 27, and finally through 24 and 28. In general, the mutual distance between the drill strings must be substantially equal to an integral multiple of the desired distance between two neighbouring wells.

Even though the invention has been described above in connection with an exemplifying embodiment showing two drill strings, it will be clear to the skilled person that more drill strings may be arranged, dependent upon the carrying capacity and stability of the vessel. Further drill strings may be arranged in line with the drill strings shown or such that they form a two-dimensional pattern. In any case, the rule given in the preceding paragraph for the mutual distance between the drill strings may be used.

Claims

1. A vessel for drilling hydrocarbon wells in the sea floor, the vessel including a drilling tower dimensional and constructed to receive at least two drill strings.

2. A vessel as claim in claim 1 and including appurtenant equipment for each of the drill strings.

3. A vessel as claimed in claim 1 or 2, wherein the mutual spacing between the drill strings is at least equal to the spacing required to enable the drill strings to be operated concurrently.

4. A vessel as claimed in claim 1, 2 or 3, wherein the number of drill strings is two.

5. A vessel as claimed in claim 4 when appendant to claim 2, wherein the appurtenant equipment for the two drill strings is arranged at a mutual angle of substantially 90°C.

6. A vessel as claimed in any preceding claim,

wherein the mutual spacing between the drill strings is substantially equal to an integral multiple of the desired spacing between neighbouring wells.

7. A vessel substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

8. A method of drilling hydrocarbon wells on the sea floor, wherein at least two wells are drilled concurrently, the wells being drilled at a mutual spacing substantially equal to an integral multiple of the desired spacing between neighbouring wells.

9. A method of drilling hydrocarbon wells substantially as hereinbefore described with reference to the accompanying drawings.

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